Dental Innovations '95
Maurice and Gabriela Goldschleger
School of Dental Medicine
Tel Aviv University
April 11th-13th, 1995

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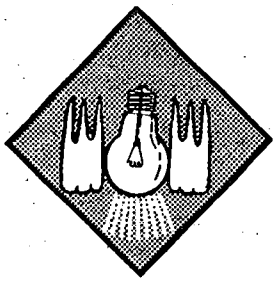
Book of Abstracts

TEL AVIV UNIVERSITY
THE MAURICE AND GABRIELA GOLDSCHLEGER
SCHOOL OF DENTAL MEDICINE

אוניברסיטת תל-אביב
בית הספר לרפואת שיניים
ע"ש מוריס וגבריאלה גולדשלגר



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Special thanks to Rita J. Lazar (English editor), Hani Tal and Gila Gilad for all their help

Dental Innovations '95
Program :

Tuesday, April 11th, 1995

18:00-21:00: Registration (registration is also possible on April 12th and 13th)
Cocktail Party

Welcome Remarks:
Prof. Haim Tal, Head, The Maurice and Gabriela Goldschleger School of Dental Medicine

Prof. Adam Stabholz, Dean, Hebrew University-Hadassah Faculty of Dentistry

Prof. Emanuel Marom, Vice-President and Dean for Research and Development, Tel Aviv University

Yoram Shamir, Public Affairs Division, Tel Aviv University

Wednesday, April 12th, 1995

8:00-8:30 Coffee

Introductory Remarks:

8:30-9:00: Dr. Yehoshua Gleitman, Chief Scientist, Ministry of Industry

Session I: Innovations in Management of Periodontal Disease

Chairpersons: Richard P. Ellen and Sandu Pitaru

9:00-9:45 Richard P. Ellen (University of Toronto): Transfer of Periodontal Research Concepts to the Clinic and Marketplace.

9:45-10:30 W.A. Soskolne (Hebrew University-Hadassah): The Use of the Perio Chip® in the Treatment of Chronic Periodontal Disease.

10:30-11:00 S.Pitaru, M. Noff, H. Tal, O. Mozes, Y. Zubery, A. Kozlovsky, N. Savion (Tel Aviv University): Novel Collagen Barriers for Periodontal Regeneration

11:00-11:30 Coffee

11:30-12:00 Moshe Zuckerman (Dumax/CTS Chemical Industries Ltd.) Elyzol Dental Gel: A New Approach to the Treatment of Periodontal Disease

12:00-12:30 Jeffrey C. Hoos (NovaDent Inc.) Perioflex: Innovative System for Subgingival Irrigation

Wednesday, April 12th, 1995 (cont'd)

Session II: Commercial Development of Academic Research

Chairperson: Irwin D. Mandel

12:30-13:00	Irwin D. Mandel (Professor Emeritus, Columbia University): Forty Years of Interactions between Academia and Industry
13:00-13:30	Karl Laden (Haifa, Israel): Using Technology Acquisition as a Source for New Products
13:30-15:00	Lunch and Exhibits

Session III: *Innovations in Restorative Dentistry*

Chairperson: Rafi Pilo

15:00-15:30	Moshe Dariel (Ben Gurion University of the Negev): Silver Composites, Possible Substitutes to Dental Amalgams
15:30-16:00	I. Shoher (Herzeliya, Israel): Captek - A Novel Metal Technology
16:00-16:20	Barry Zalsman, (B.J.M. Lab. Ltd.): High-Q-Bond Plus, New Fourth Generation Multipurpose Bonding, Cementing and Covering System
16:20-16:40	Rafi Pilo (Tel Aviv University): The Influence of Long-Term Water Storage on the Durability of the Shear Bond Strength of New Adhesive Systems to Fresh Amalgams
16:40-17:30	Discussion

Thursday, April 13th, 1995

Session IV: Innovations in Antimicrobial Therapies

Chairperson: Doron Steinberg

8:30-9:00	S. Shani, D. Steinberg and M. Friedman. (Hebrew University-Hadassah): A Sustained release device containing amine-fluorides for local treatment of oral infectious diseases.
9:00-9:30	Mel Rosenberg, A. Rogatky and A. Kozlovsky (Tel Aviv University): Malodor Reduction by Assuta ™ Mouthrinse

Thursday, April 13th, 1995 (cont'd)

9:30-10:00	Doron Steinberg (Hebrew University-Hadassah): Controlled Release Devices for Oral Use: Fantasy or Reality?
10:00-10:30	Coffee

Session V: Innovations in Bone

Chairperson: Daniel van Steenberghe

10:30-11:15	D. van Steenberghe, I. Naert, M. Smet, V. DeBuck, B. Swaelens (Catholic University of Leuven): Maxillary Bone Augmentation by Means of Particulared Allogenous Bone Grafts or a Custom Fit Titanium Membrane.
11:15-11:45	Itai Bab (Hebrew University-Hadassah): Osteogenic Growth Peptide (OGP) for Stimulation of Bone Formation.

Session VI: Innovations in Dental Equipment

Chairperson: Alexander D. Vardimon

11:45-12:15	Adit Romano (Oraline Ltd.): Oral Spring: A Spring-Activated Toothbrush that Adapts Itself Completely to the Contours of the Mouth
12:15-12:35	Yehoshua Raif (Laser Industries Ltd.): Lasers in Dentistry.
12:35-12:55	Shlomo Barak (Sourasky Medical Center, Tel Aviv): Clinical Applications of CO_2 Laser in Oral Surgery and Periodontology.
12:55-14:30	Lunch and Exhibits
14:30-15:00	Alexander D. Vardimon, T. Brosh, and M. Labeeb (Tel Aviv University): The TDCP - a Device to Measure the Tightness of Dental Contact Point
15:00-15:30	Ran Tuttnauer (Tuttnauer Co. Ltd.): Novel Sterilization and Infection Control Procedures
15:30-16:00	M.M. Nir and G. Ramirez (StePac L.A., Ltd.): Properties of Nylon Sterilization Pouches in Table-Top Sterilization Processes.
16:00-16:30	Coffee
16:30-17:00	A. Elboim, S. Calderon, I. Gannot, J. Dror and N. Croitoru (Tel Aviv University, Beilinson Medical Center): Treatments in the Oral Cavity Employing Flexible Waveguide

Closing Remarks:

17:00-17:30	M. Silbermann, Chief Scientist, Ministry of Health.

Transfer of Periodontal Research Concepts to the Clinic and Marketplace. **R.P. Ellen** (Department of Periodontics, University of Toronto, Canada)

The biotechnical revolution of the past decade has accelerated the clinical application of concepts, innovations, devices and pharmaceuticals derived from international periodontal research and development efforts. The major thrusts in applied sciences are focused in five directions: diagnosis, antimicrobial therapy, anti-inflammatory therapy, regeneration of resorbed periodontal tissues, and implant-supported reconstruction of the dentition. The purposes of the presentation are to discuss research concepts in the area of periodontal diagnosis that have led to innovations being brought to the clinic setting and the marketplace, and to highlight how innovations in diagnosis facilitate the development of the antimicrobial, regenerative and reconstructive innovations that subsequent speakers will discuss. Most innovations in diagnosis address fundamental characteristics of the micro-environment of periodontal pockets and the adjacent periodontal tissues.

Since the introduction of the millimeter scale on the periodontal probe by CHM Williams, Univeristy of Toronto, probing pocket depth and subsequently gingival attachment level measurements have been the gold standard of periodontal diagnosis. The past decade has seen the sophistication of the periodontal probe in formats including pressure sensitive electronic probes and most recently computerized probes that control angulation, force, probing velocity, and store and analyze measurements automatically. Characteristics of the automated probes will be compared and their commercial potential discussed.

Research to define the microbial etiology of periodontal diseases has fostered research and development of laboratory services and on-site clinical tests to monitor the detection frequency and levels of putative pathogens in periodontal pockets. Commercially available services in North America include cultivation and antimicrobial sensitivity testing and the identification of key pathogens by hybridization with DNA probes. On-site clinical kits that rely on identification of bacteria by either specific antibodies or by monitoring for protease activities limited to clusters of periodontal pathogens are already available to dentists in some jurisdictions. Technology for the rapid, on-site monitoring of putative pathogens by oligonucleotide hybridization is available for reserach purposes and is being developed for eventual use by practicing dentists. Research that has documented the nature of inflammatory reactions in the gingiva has also stimulated the development of laboratory and on-site clinical tests to monitor periods of periodontal disease activity. A test under development, based on matrix metalloprotease activity in whole mouth samples, and a commercially available, site-specific test based on aspartate aminotransferase activity in crevicular fluid will be discussed.

Together with the evolution of radiographic imaging and nuclear medicine technology for measuring changes in alveolar bone, the field of periodontal diagnosis targeted at the environment of periodontal pockets is experiencing a boom in innovations that will eventually dominate the marketplace. Improved accuracy in diagnosis should facilitate clinical trials investigating the efficacy of new directions in antimicrobial therapy, anti-inflammatory therapy, regeneration of the periodontium, and implant-supported prostheses for replacing the dentition.

The Use of the Perio Chip® in the Treatment of Chronic Periodontal Disease. **W.A. Soskolne** (Department of Periodontics, Hebrew University-Hadassah Faculty of Dental Medicine, Jerusalem)

The development of sophisticated, subgingivally placed delivery systems has advanced forward over the last decade. The Perio Chip® is a degradable sustained release delivery system, in which 2.5 mg of chlorhexidine is released subgingivally at the periodontal disease site. This system was developed in a collaborative effort between scientists at Hebrew University, Hadassah Medical Organization and Perio Products. The purpose of this presentation is to briefly discuss these developments and to describe a multicenter clinical trial to study the safety and efficacy of the Perio Chip®.

The safety and efficacy of the Perio Chip® were evaluated in a randomized, double-blind study made up of 131 patients. However, only 100 patients completed the study. Two treatments were compared in a split-mouth design with the affected teeth in the quadrants on one side of the mouth receiving scaling and root planing, while the teeth in the quadrants on the opposite side received both scaling and root planing and the Perio Chip®. Scaling and root planing were performed at baseline, while the Perio Chip® was inserted at baseline and at 3 months. Clinical and safety measurements were taken at baseline, 1 month, 3 months and 6 months.

The clinical parameters measured were probing pocket depths (PPD) and probing attachment levels (PAL) from a prefabricated stent gingival plaque and staining indices and bleeding on probing. A general oral examination was also carried out. The average PPD reduction in the Perio Chip® treated sites was statistically significantly better ($p \leq 0.01$) than in the sites that received only scaling and root planing, with a clinically significant difference of 0.42 mm. The average PAL reduction, although greater in the sites receiving the Perio Chip® was not statistically significant. However, an analysis of patients with pocket depths of 7-8 mm (n=47), revealed greater reductions in both PAL (0.56 mm) and PPD (0.71 mm) in the patients receiving the Perio Chip®. These differences were statistically significant and were evident at the 3 and 6 month visits.

The results indicate that the use of the Perio Chip® as an adjunct to scaling and root planing provides a clinically significant improvement in the clinical parameters associated with periodontal disease and are particularly significant in the deeper pockets. These results should have a significant influence on the provision of periodontal therapy in the market place.

Novel Collagen Barriers for Periodontal Regeneration. **S. Pitaru, M. Noff, H. Tal, O. Moses, Y. Zubery, A. Kozlovsky, N. Savion** (School of Dental Medicine, Tel Aviv University; Orthopedic Department, Assaf Harofe Hospital; Eye Research Institute, Faculty of Medicine, Tel Aviv University, Israel)

The purpose of this study was to assess the capacity of Colbar, a novel collagen barrier, to support periodontal regeneration using the guided tissue technique (GTR). The Colbar barrier is a biodegradable barrier which consists of pepsinized type I bovine collagen stabilized by a novel technology developed by S. Pitaru and M. Noff. This technology uses a non-toxic natural biological agent to stabilize and cross-link the collagen fibers and consequently to control the rate of degradation of the Colbar barrier. In addition to being hemostatic, the barrier exhibits high affinity for periodontal tissues and, therefore, it adheres to the supporting tissues without requiring suturing. The capacity of Colbar barriers to support periodontal regeneration was first tested in the dog model. It was found that Colbar barriers allowed for 95% regeneration of the size of dehiscence lesions in all experimental sites. New cementum, periodontal ligament and supracrestal alveolar bone, and the establishment of a new physiological dentogingival junction were observed in lesions treated with Colbar barriers. Control lesions healed by long junctional epithelium.

The capacity of Colbar barriers to support periodontal regeneration in humans was tested in class II furcations and infrabony defects. In a split mouth study undertaken in seven patients, it was found at re-entry that six out of seven class II furcations treated with Colbar barriers according to the GTR technique were completely filled with bone-like tissue. Contralateral control sites treated only by debridement and root planing exhibited partial bony filling only in one out of seven sites. Colbar barriers proved efficient in the regeneration of circumferential infrabony defects related to teeth and artificial implants. Local or systemic adverse reactions were observed in none of the treated patients.

The animal and human studies indicate that the Colbar barrier is an efficient and safe tool for achieving the regeneration of periodontal tissues.

Elyzol Dental Gel. A New Approach to the Treatment of Periodontal Disease. **M. Zuckerman** (CTS Chemical Industries Ltd, Tel Aviv, Israel)

A system that delivers the antibiotics directly to the infectious site, the periodontal pocket, presents obvious advantages over the systemic treatment: high concentrations of the antibiotic in the infected site with a significantly smaller amount of active substance; and reduced risk of side effects due to the decreased systemic load of antibiotics. This means that an appropriate delivery system for local administration could lead to increased efficacy of the antibiotic with a reduced risk of systemic side effects.

Elyzol 25% dental gel is the first patented delivery system containing metronidazole for local treatment of periodontitis. The formulation of Elyzol 25% dental gel is based on the ability of mixtures of mono- and tri-glycerides to form liquid crystals in contact with water. The product is easily administered at room temperature with a syringe. When applied into the gingival pocket, the formulation flows into and fills the pocket evenly. On contact with the gingival fluid, it transforms into a firm gel which adheres to the pocket mucosa. Metronidazole benzoate, which is used in the formulation, is slowly released from the matrix and hydrolyzed enzymatically in the gingival fluid into the active metronidazole. The gel matrix degrades slowly and disappears from the dental pocket.

Elyzol 25% dental gel was tested and compared with conventional scaling and root planing in a split mouth designed study, *i.e.*, the patient served as his own control. Each patient had one session of scaling and root planing in two quadrants and two applications of Elyzol 25% dental gel in the other two quadrants. The pivotal studies included 291 patients with 7411 sites with a probing pocket depth of more than 5 mm. The clinical test parameters were probing pocket depth and bleeding on probing. The patients were followed for 6 months after treatment with measurement of the test parameters at 2, 6, 12, 18 and 24 weeks. The results indicate that the two treatments are equally effective in reducing probing pocket depth and bleeding on probing. The effects of both treatments persisted for the 24-week follow-up period with no indication of reversal to the clinical status before treatment. Treatment with Elyzol 25% dental gel did not induce serious or unexpected side effects.

Elyzol 25% dental gel is the first patented delivery system containing metronidazole for local treatment of periodontitis. Its unique technical qualities and the substantial documentation supporting its efficacy and safety signify that a new well-suited antibiotic treatment is available to the dental profession to treat infectious disease which was previously treated by mechanical means.

Perioflex: Innovative System for Subgingival Irrigation. **J. C. Hoos** (NovaDent, Inc., Woodbridge, Connecticut, USA)

Numerous studies have demonstrated the effectiveness of oral subgingival irrigation for the control of the bacterial plaque within periodontal pockets. However, so far only rigid, blunt ended, metal canulaes with side-port openings have been offered for this purpose. When used for home care by non-professionals, this type of probe introduces the risk of traumatizing the soft tissue pocket wall and epithelial attachment; and the discomfort involved in tooth sensitivity resulting from the contact of the root surface with metal. To overcome these limitations, the Perioflex irrigation probe consisting of a short (6 - 10 mm), flexible plastic canulae with a rounded tip and three side-ports oriented at 120 degrees relative to each other and located 0.5 - 4.0 mm proximal to the tip, was developed. The flexable canulae is attached to a rigid plastic introducer with a "dental" angle. An innovative Perioflex Syrette (flexible bulb dispenser), to which the Perioflex probe is easily assembled, was also developed to simplify the home-care irrigation procedure. The Syrette fits comfortably into the hand for easy use. Both, introducing the probe into the pocket and dispensing the irrigation solution, essentially require a single operation. In addition, the Syrette features fluid injection when held in any direction and prevention of retrograde or back flow of oral fluids into the device.

Clinical trials with the Perioflex System have demonstrated the attainability of a high level of compliance by patients instructed by hygienists. The daily self-administered subgingival irrigation resulted in non-bleeding, healthy looking gingiva in essentially all cases. The Perioflex probe is also useful for interdental irrigation as suggested by preliminary observation in teenagers, showing the disappearance of bleeding from the interdental papillae. These results indicate that the Perioflex System offers a realistic, effective and inexpensive approach to soft tissue management.

Forty Years of Interactions Between Academia and Industry. **I.D. Mandel** (Professor Emeritus, Columbia University, New York)

During the past decade, there has been a marked increase in the extent of academic-industrial interactions in the oral health area. Such relationships, however, are not a new phenomenon. Indeed, it has been a fertile coupling for more than 40 years, resulting in a succession of begats that began in the 1950s at the University of Indiana (USA) with the development of stannous fluoride for topical treatments, and then in the first effective fluoride toothpaste - Crest - a joint venture with Procter & Gamble (USA). The original research for the amine fluoride dentifrice - Elmex - was at the University of Zurich. Acidulated phospho-fluoride, APF, is a product of research at Forsyth Dental Center and subsequent development at a Colgate subsidiary. Other significant contributions to caries prevention include Xylitol chewing gum at the University of Turku (Finland) and the University of Michigan (USA) and interaction with LEAF (Holland); caries activity and susceptibility tests at the University of Oulu (Finland) and development at Orion Diagnostics and Vivadent. New developments in treating dentin hypersensitivity came from liasons between researchers at Columbia University (USA) and Medical College of Georgia (USA) and the Block Drug Co (USA). Investigators at numerous universities and research centers are responsible for sealants, composites, bonding agents, a range of periodontal treatments, and an extensive list of physical, chemical and biologic devices and tests subsequently marketed by industry. The pace is accelerating. Industry-academic interactions have taken a variety of forms complementary to the corporate mission. These are continuing to evolve to the mutual benefit of both parties and to the common goal of transforming new scientific knowledge into clinically useful applications.

Using Technology Acquisition as a Source for New Products. **K. Laden** (Technology Transfer, New Product Development Consulting, Haifa, Israel)

Technology acquisition can offer companies an opportunity for growth within existing business areas by diversification. Successful technology acquisition requires a sustained expenditure of time and effort to investigate opportunities outside of a company's own R&D laboratory. Licensing technology has played a significant role in the growth of many companies, both large and small, as well as in effecting national economic growth.

Using outside ideas can often help companies enter new business areas faster and with less risk than developing the technology in-house. There are a vast array of sources for finding new ideas, which include private inventors, technology brokers, universities, government laboratories and other companies.

Once a new technology of interest is identified, the financial, legal and transfer problems can be complicated. Overcoming the resistance of a company's own scientists to accept outside technology requires management to recognize the complexities of the technology transfer process.

Frequently the process of moving purchased technology to the marketplace involves as much or more inventiveness than the original discovery. The rewards, both financial and recognition for successfully completing this process, must be equal to those given for ideas originating within a company.

Finding and transferring technology requires a company to commit to an ongoing program of looking for good ideas elsewhere. It also requires an understanding that the rewards from such an effort are difficult to predict and are not likely to occur often. Outside assistance in searching for new ideas can sometimes help companies unwilling or unable to commit their own personnel to such activities. After screening multiple sources for new ideas, the technology consultant brings only the more promising ideas to the attention of the company.

Silver Composites, Possible Substitutes to Dental Amalgams. **M.P. Dariel** (Department of Materials Engineering, Ben-Gurion Univeristy of the Negev, Israel)

The environmental and occupational hazards associated with the mercury content of dental amalgams are a recurring source of public concern. This presentation will describe an ongoing project aimed at finding a viable metallic alternative to dental amalgams. The proposed substitute is a silver-based metallic composite consisting of a matrix and embedding pre-alloyed and *in situ* formed silver-tin intermetallic compounds. The condensability of a mixture of the constitents in powder form relies on cold-welding that takes place between suitably surface treated silver interfaces. Surface treatment itself consists of exposing the silver surface to a mild, oxide removing acid. The required mechanical properties are attained by a proper balance between the various components. A short review of the achievements and the shortcomings of the project at its present stage, will be discussed.

Captek - A Novel Metal Technology. **I. Shoher** (Herzeliya, Israel)

Captek - capillary attraction casting - is a new technology for the formation of a metal composite base for ceramo-metal restorations. The different components constituting a metal composite do not completely diffuse into each other as in homogenous metals, but each component maintains its original composition and properties. A composite metal can be designed to have properties that may not be obtained in a single homogenous precious alloy. Captek composite metals contain 80-90% gold and about 17-18% platinum group metals. There are three Captek metals for ceramo-metal restorations: to form copings, to connect copings and pontics to form bridge structures, and to make additions and corrections in Captek metal structures.

All Captek materials are made of two major components. The first forms during a heat process by joining individual particles, a three-dimensional network of capillaries and the other, when melted fills the network by capillary diffusion to form a solid composite metal. The Captek coping is constructed of three layers that form during the heat treatment. The inner and outer layers are about 30 μm thick and have a bright gold color and a granular surface texture. The intermediate layer has a gold-platinum color. Even though theouter layer formed a strong bond with procelain, it is recommended to use Capbond as a cermo-metal bonder for extra security.

The vital natural esthetics of Captek ceramo-metal restorations are attributed to the gold color oxide free surface of the Captek composite metals. Captek was found to develop highly accurate gingival margins and exceptionally strong crowns and bridges (Dr. Juntavee, PhD thesis, Boston University, Dec. 1994). Captek metal structures were clinically found to be highly biocompatible when in contact with the periodontal tissues.

High-Q-Bond Plus, New Fourth Generation Multipurpose Bonding Cementing and Covering System. **B. Zalsman, H. Dodiuk, I. Eppelbaum, A. Valdman, S. Shoshan, M. Redlich** (BJM Lab. Ltd, Rafael Armament Development Authority, Connective Tissue Research Laboratory, Hadassah, Jerusalem, Israel)

An advanced universal dental adhesive system, composed of acrylic monomers and coupling agents was developed, characterized by high bond strength to different substrates, enhanced durability and biocompatibility. The composition is self-cured, but can be cured alternatively by use of visible light. Using the notion of anaerobic nature of radical curing of acrylic adhesives, commonly used in dentistry, a new dental composition was developed by adding an anaerobic accelerator benzoic sulfimide - saccharin. This was shown to increase curing speed, enhance tensile adhesion bonding and durability by optimizing the curing mechanism. Up to 0.8% W of saccharin decreased activation energy of curing by generating a new wave of active radicals, and increased the adhesion bonding obtained between High-Q-Bond Plus™ (HQB) and a variety of surfaces. Incorporation of saccharin in excess of 1% increased activation energy and decreased the tensile bond strength, probably due to excess of free radicals obtained, which leads to intensifying radical termination reactions (*e.g.*, recombination). By using the developed kinetical results, it was possible to receive high and consistent bonding between HQB composition and such substrates as dentin, enamel, base and precious cast alloys, set and fresh amalgams, and dental porcelain.

The tensile adhesion strength was determined using a Lloyd mechanical tester (computer controlled), according to ASTM D897, crosshead speed 5 mm/min; 8-10 specimens for each sum. Specimens consisted of polymethylmethacrylate rods, 5 mm in diameter, bonded using tested adhesives, to different substrate materials. After bonding all specimens were maintained at ambient temperature for 24 h and stored in water at 37°C for an additional 24 h. A comparison of bonding durability to base and precious cast alloys of three different dental adhesives: Resiment (Re), C&B Meta-bond (C&B), and High-Q-Bond (HQB) was carried out by thermocycling. Tensile adhesion strengths to base cast alloys before thermocycling were Re - 6.0 MPa, C&B - 16.5 MPa and HQB - 20.0 MPa; after 120 cycles Re exhibited 100% bond failure, C&B showed 33% and HQB showed 40%. Tensile adhesion strengths to precious cast alloys before thermocycling were Re - 7.0 MPa, C&B - 7.8 MPa and HQB - 13.0 MPa; after 120 cycles Re exhibited 100% bond failure, C&B showed 80% and HQB showed 2.3%. HQB Plus durability properties are at the same range or even superior to those of other tested adhesives. Contact between HQB adhesive cement and the gingiva is inevitable during cementing/filling procedures. Thus, the biocompatibility of these materials is a prerequisite for any such dental procedure.

The tolerance of gingival tissue to HQB adhesive was tested in dogs. Buccal class V subgingival cavities were performed on maxillary lateral incisors. Cavities were filled with either HQB or with the cementing agent Super Bond™ (SB). Untreated teeth served as normal intact controls. Teeth with the buccal gingiva attached were extracted 6, 14 and 20 days after filling and processed for histologic examination. After 6 days, inflammatory cells and dilated blood vessels were noted in the gingival stroma of the SB treated teeth. The stroma of HQB treated teeth was that of normal tissue with only a solitary inflammatory focus. After 14 days, the gingival stroma of the SB teeth was still inflammed; the HQB treated teeth including the subepithelial area were practically without any notable inflammation or vascular abnormality. After 20 days, extensive inflammatory response was seen in the free gingiva subepithelial stroma of the SB treated teeth, whereas the HQB filling had no notable effect on the gingival tissue which closely resembled that of the intact control. Results indicate tissue friendliness of the High-Q-Bond Plus system, with less inflammation in the free gingival after filling of class V subgingival cavity.

The Influence of Long-Term Water Storage on the Durability of the Shear Bond Strength of New Adhesive Systems to Fresh Amalgam. **R. Pilo, T. Brosh, H. Dodiuk** (The Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Israel)

Strong durable resin bond to fresh amalgam is desired in composite-veneered amalgam restorations, as well as in adhesive amalgam restorations. The purpose of this study was to compare the shear bond strength (SBS) of composite resin (Brilliant, Coltene), bonded to fresh amalgam (Oralloy, Coltene) using All-Bond 2 (AB, Bisco), Amalgambond Plus, (AP, Parkell), High-Q-Bond (HQ, BJM Lab) and Comspan (CO, LD Caulk).

Sixty cylindrical specimens, 6 mm x 6 mm, composed of equal parts of amalgam and composite resin, with a bonding material in between were prepared for each adhesive system. Specimens were divided into three subgroups, immersed in saline at 37°C for either 48 h, 3 months or 6 months. After storage, all specimens were thermocycled 500 times and tested for SBS in an Instron testing machine. The data were analyzed by a two-way analysis of variance and Bonferroni multiple comparisons test. SBS (MPa) for HQ at 48 h (6.31±1.59), 3 months (8.16±2.33) and 6 months (7.63±1.1) did not differ significantly. SBS values for CO at 48 h (4.05±2.25), 3 months (3.03±2.65) and 6 months (3.51±2.35) were not significantly different. AP did not deteriorate during 3 months (5.02±1.34 compared with 5.85±1.91), but decreased a statistically significant amount over 6 months (2.95±1.86, $p<0.01$). AB deteriorated progressively from 5.27±1.9 at 48 h to 1.57±1.37 at 3 months and 0.28±0.16 at 6 months ($p<0.001$).

Deterioration in bond strength correlates with changing mode of failure, from mostly cohesive after 48 h to mostly adhesive after 6 months. The infrared spectra of the amalgam debonded surfaces of the adhesives undergoing deterioration in SBS revealed a broad water absorption with disappearance of the carbonyl peak. The requirements from adhesive systems to fresh amalgam are cohesive mode of failure, high SBS values, and resistance to active hydrolysis over long duration of water immersion.

A Sustained Release Device Containing Amine-Fluorides for Local Treatment of Oral Infectious Diseases. **S. Shani, D. Steinberg, M. Friedman** (School of Pharmacy and School of Dentistry, Hebrew University-Hadassah, Jerusalem, Israel)

Dental diseases are among the most wide spread chronic disorders affecting mankind. Oral bacteria cause both dental caries and periodontal diseases. Eliminating cariogenic and periopathogenic bacteria is an important step in preventing and healing these diseases. Antibacterial drugs for these diseases can be administered several ways. Drugs administered systemically are diluted several thousand-fold before reaching the infection site; locally, the use of mouthwash may fail to maintain therapeutic concentrations for sufficiently long periods to have any effect. Local sustained release delivery (SRD) systems extend the time the drug is present in the oral cavity, thus enhancing its therapeutic potential and reducing side effects. Amine-fluorides have been used as anti-caries agents for over 30 years and have recently been found to have an antibacterial effect against periodontal pathogens. Amine-fluoride molecules consist of two functional groups - the organic amine, which is a surface active agent and the fluoride ion. The purpose of this study was to develop a SRD containing amine-fluoride for local treatment of oral infectious diseases. This would combine the advantages of fluoride as an anti-caries agent and organic amine as an antibacterial agent, as well as advantages of a local sustained delivery system.

The antibacterial activity of the two functional groups of amine-fluoride molecules were determined. Minimal inhibitory/bacteriocidic concentration (MIC/MBC) for *Streptococcus sobrinus* 6715, was pH between 5 to 7. Amine-fluorides had similar MIC values to that of chlorhexidine digluconate at all tested pH values, thus showing a high antibacterial activity against *S. sobrinus* 6715. The MIC values of amine-fluorides and amine-chlorides were similar and about 100 times lower than the MIC value of NaF. No synergistic effect was found between fluoride and organic amine. Therefore, the antibacterial activity of amine-fluorides derives mainly from organic amine and not from fluoride. A SRD was developed based on an ethyl-cellulose matrix cast from chloroform containing amine-fluorides. Drug release experiments were conducted in diffusion cells containing 50 ml of distilled water at 37°C. Since both organic amine and fluoride are active, but have different pharmacologic effects, the concentration of each were separately determined. A quantitative analysis of the drug's concentration was carried out for fluoride by an ion specific electrode connected to a pH-meter, and for organic amine by a spectrofluorometer reading the fluorescence produced by the reaction of the organic amine with the fluorescence reagent fluorescamine. Drug release profiles were modulated by varying initial drug concentration and film thickness. By changing the pharmaceutical formulation, controlled drug release was attained up to 21 days. Fluoride and organic amine were released by different kinetics; the fluoride was released faster than the organic amine. Organic amine was well correlated ($r=0.998$) with Higuchi's model for diffusion controlled release from non-degradable matrix. The antibacterial activity of our device was assessed in a previous study. Samples from the diffusion cell were taken at different ime points and added to test tubes containing broth media and *S. sobrinus* 6715. At any time during its release, the drug's concentration was above its MIC value and no bacterial growth was observed. The device has the potential to become part of the treatment or prophylactic treatment for both caries and periodontal diseases.

Malodor Reduction by Assuta™ Mouthrinse. **M. Rosenberg, A. Rogatky, A. Kozlovsky** (The Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Israel)

Assuta™ mouthrinse is a proprietary two-phase oil-water mouthrinse that was developed following 10 years of university research showing that oral bacteria have a tendency to bind to oil droplets (M. Rosenberg, H. Judes, E. Weiss, *Infection and Immunity* 42:831-834, 1983). Assuta™ is produced in Israel by Shemen Soad Ltd, which obtained a licence to manufacture and distribute the mouthrinse in Israel from Ramot Ltd (the applied arm of Tel Aviv University). Since its introduction in 1992, Assuta™ has become the leading mouthwash in Israel, outselling some 18 local and imported brands in most outlets. A highly successful mint version was introduced in 1994.

In addition to the distinct aqueous and oil phases, Assuta™ contains the anti-bacterial agent cetylpyridinium chloride which (i) enables a temporary emulsion to be formed, so that both phases can be incorporated into a single bottle; (ii) binds to the surface of bacteria and debris, increasing their adhesion to the oil droplets; and (iii) has potent antibacterial activity. Assuta™ is alcohol-free.

Initial experiments suggested that in addition to its bacteria-binding properties, Assuta™ has a long-term effect in reducing bad breath. The purpose of the present study was to compare the antimalodor properties of the two-phase oil-water mouth-rinse, Assuta™ (Shemen Soad Industries Ltd), with those of the world's leading mouthrinse, Listerine™ (Warner-Lambert Co). Fifty volunteers rinsed with one of the two mouthwashes for 30 seconds twice a day over 6 weeks. Malodor of whole mouth, as well as tongue dorsum anterior and posterior, was assessed on a 0-5 scale by two odor judges. Volatile sulfide levels were determined using a sulfide monitor (Interscan Corp, model 1170). Measurements were made $\geq$9 hours following rinsing, at time zero and following 1, 3 and 6 weeks. Results were analyzed by two-tailed covariant ANOVA, with the time zero value as covariant. As compared to time zero scores, whole mouth odor, tongue dorsum anterior and posterior odors decreased continuously over time, attaining 81%, 79% and 78% reductions, respectively following 6 weeks in the Assuta™ group vs. 71%, 78% and 59% for the Listerine™ group. For whole mouth and tongue dorsum posterior, the reductions observed in the Assuta™ group were significantly greater than those obtained with Listerine™ ($p=0.026$ and $p=0.025$, respectively). As compared to time zero, peak sulfide readings at 6 weeks were reduced by 0.42 in the Assuta™ group as opposed to 0.21 in the Listerine™ group.

Following the study, subjects were asked to comment freely on the mouthrinse they used. Whereas Assuta™ users gave the mouthwash 24 positive remarks as compared with 8 negative ones, the Listerine™ users gave it only 15 positive remarks as compared with 26 negative comments. The data suggest that Assuta™ is superior to Listerine™ in long-term reduction of oral malodor and acceptability.

Controlled Release Devices for Oral Use: Fantasy or Reality? **D. Steinberg** (Faculty of Dentistry, Hebrew University-Hadassah, Jerusalem, Israel)

Local delivery of slow release devices (SRD) in treating oral diseases offer a promising alternative means of therapy. These devices can also serve as an adjunct to a conventional therapy. The primary advantage of SRD is the low ratio of the amount of drug administered to the concentration of the drug found in the target site. Several SRD were introduced to the dental profession more than a decade ago. Among the popular SRD dosage forms are varnishes, gels, slabs/films and fibers. Topical slow release varnishes are applied for preventing dental plaque, for anti-caries medicaments, for treatment of hypersensitive teeth, and for teeth whitening. Slabs, fiber and gels are designated as drug delivery systems to the periodontal picket in the treatment of periodontal diseases. Several of these applications are commercially available, while others are currently in premarketing stages.

The ideal SRD has a lower risk-benefit ratio than the systemic or local administering of drugs to the oral cavity. There are numerous advantages over conventional treatment, that include controlling and monitoring the desired drug concentration in the site, high efficacy, and minimal side effects, such as unpleasant tests or tooth staining. As well, the use of SRD will result in high patient compliance.

SRD are more beneficial than systemic or local administration of drugs to the oral cavity. Degradable local sustained SRD are superior to non-degradable devices because of a higher patient compliance (return visits to the dentist are eliminated). In addition, the complete degradation of the matrix assures delivery of the loaded drug into the site. However, several clinical and pharmacological issues may be associated with SRD. Controlling the release of the drug is a highly sophisticated pharmaceutical technique. Maintaining the drug in the site within the therapeutic window is a crucial pharmacological factor in these applications. The release of a drug is dependent not only on the matrix, but also on the surroundings. A high influx of saliva or gingiva fluid can result in a more rapid drug depletion from the matrix. A biodegradable device exhibits additional problems, since the degradation of the matrix influences the release rate of the drug.

Clearly, SRD are a preferred pharmaceutical method for drug delivery systems that are intended to prevent and control dental diseases and disorders. There is little argument that the concept behind the local administering of SRD is both revolutionary and advanced. Once fully perfected, these types of drug delivery systems will be widely implemented in dentistry.

Maxillary Bone Augmentation by Means of Particulared Allogenous Bone Grafts or a Custom Fit Titanium Membrane. **D. van Steenberghe[1], I. Naert[2], M. Smet[3], V. DeBuck[4], B. Swaelens[5]** ([1]Department of Periodontology, [2]Department of Prosthetic Dentistry, [3]Department of Radiology, Catholic University Leuven, [4]Ceka, Antwerp, [5]Materialise, Leuven)

The use of osseointegrated oral implants to rehabilitate edentulous maxillae has led to the application of this approach to even anatomical defects or advanced resorptions. In the latter cases, the bone volume must be increased to allow proper seating of the implants. Different treatment approaches have been proposed involving the use of corticocancellous autogenous onlay and inlay grafts. The latter involve general anesthesia and relatively serious post-operative pain. On the other hand, the long-term success rate is above 90%.

The desire to treat these difficult situations under local anesthesia and by less elaborate surgical techniques has led to the use of particulared allogenous bone grafts (deproteinized bovine bone, Bio-Oss®) or customized titanium membranes. Both techniques are in an early stage of clinical trials. The provisional data look promising but further histological and clinical evaluation is needed.

The use of deproteinized allogenous bone material offers the advantage not to transfer any viral or antigenic factor. The use of a custom fit titanium membrane produced on the basis of a stereolithographic cast derived from CT scan data, makes surgery easy and tissue reactions very favorable.

Osteogenic Growth Peptide for Stimulation of Bone Formation. **I. Bab, M. Vidson, M. Namdar, A. Shteyer, M. Chorev, A. Muhlrad, D. Gazit** (Faculties of Medicine and Dental Medicine, The Hebrew University-Hadassah, Jerusalem, Israel)

The osteogenic growth peptide (OGP), a 14 amino acid polypeptide identical to the C-terminal region of histone H4, was recently characterized in regenerating bone marrow. It is also abundant in normal mammalian serum, including man. A marked increase in serum OGP accompanies the osteogenic phase of post-ablation marrow regeneration and the associated systemic osteogenic response, suggesting a role for OGP in this reaction. *In vitro* OGP is an autocrine mitogen of osteoblastic and fibroblastic cells. It also stimulates alkaline phosphatase activity and matrix mineralization. In normal and osteoporotic rodents, the OGP and especially its naturally occurring pentapeptide analogue OGP (10-14) enhance bone formation. Of particular interest is the effect of OGP treatment studied in a model for type I osteoporosis in ovariectomized mice. When left untreated, these mice lose 60% of their trabecular bone within 4 weeks. This is accompanied by a similar decrease in serum OGP and osteocalcin and 80% decrease in tetracycline uptake. These parameters are corrected dose-dependently by daily administering of synthetic OGP (10-14) (sOGP), 0.01-1000 ng/mouse/day. These data indicate a potential role for OGP-based therapy in the enhancement of bone formation in instances such as osteoporosis and bone defects, including periodontal disease. In addition, the OGP treatment may become useful for the stimulation of osseointegration in dental and orthopedic implantation.

Oralspring: A Spring Activated Toothbrush That Adapts Itself Completely to the Contours of the Mouth. **A. Romano** (Oraline, Israel)

In the beginning of the 1950s, it was obvious that a new, dynamic toothbrush was needed, one that would adapt itself to the contours of the mouth. Many patents for dynamic toothbrushes have been registered since, especially those that are spring-mounted. However, none of these ever reached the consumer market, since there was no technology to implement the patent and to mass produce, with a price that would be competitive with those of conventional toothbrushes.

A young Israeli hygientist was among those who understood that conventional toothbrushes did not solve the problem of accumulated plaque. Therefore, a new and dynamic toothbrush was needed, one that would be more effective and would clean better without changing the consumer's brushing habits. This concept was brought to the attention of an Israeli investor who decided to implement and construct this first dynamic toothbrush. Together with a R&D team, they succeeded in producing a new spring activated toothbrush. Today, this unique technology (spring production and toothbrush) is patent registered world wide.

The market has grown significantly since the 1980s. Larger companies started to invest in new designs, in different brush heads, and in mass advertising, turning this market from a commodity market (which initially was based on a product that cost less than $1.00) into a brand name market. Basically, all innovations concerned the bristles and their ability to reach into the interdental crevices, *i.e.*, rippled bristles by Crest or different length of bristles by Colgate Precision. However, these toothbrushes still remained static.

Oralspring is the only spring-mounted toothbrush with the unique ability to completely adapt to the contours of the mouth. The spring plate mechanism is of stainless steel, a material used for medical purposes, with no limitations as to its use. The end product was released to the market only after it was completely perfected. The perforation of the brush head enables the user to clean the toothbrush completely. The combination of soft outer bristles with somewhat harder inner bristles, the polycarbonate handle, the special wall hanger, the head cover, and even the package all reflect the innovation of the product.

Lasers in Dentistry. **J. Raif** (Laser Industries Ltd., Tel Aviv, Israel)

The large dental market has attracted the attention of surgical laser manufacturers since the early 1970s. However, major obstacles particularly relating to hard dental tissues, have prevented lasers from becoming a routine clinical dental tool. A review of the activity in this field over the past 10 years will be presented. In contrast to hard tissue applications, soft tissue applications in oral, maxillofacial and periodontal surgery have been established and are gaining in popularity. For this market, Sharplan has combined its advanced CO_2 laser technology with new innovative developments in beam delivery systems to design the most compact and flexible dental laser. It offers non-contact hemostatic surgery, inherent sterilization, reduced surgical time and minimal post-operative discomfort. The design and performance of Sharplan's DentoLase 15F will be discussed.

Clinical Applications of CO_2 Laser in Oral Surgery and Periodontology. **S. Barak** (Sourasky Medical Center, Tel Aviv, Israel)

The CO_2 laser has a decided advantage in surgery of the oral cavity. This advantage is related to the ability to perform accurate hemostatic surgery, while simultaneously sterilizing the operative area. Lesions of various kinds can be treated either by excision or vaporization. In the latter case, anesthesia can be avoided by using the pulsed mode. Minimal post-operative pain and edema with rapid healing results in speedy recovery without significant discomfort. During the last 8 years, more than 1500 patients have been treated with the CO_2 laser (Sharplan 1020) in our hospital. A variety of benign and malignant tumors - squamous cell carcinomas, pyogenic granulomas, fibromas, papillomas, peripheral giant cell granulomas - were excised or vaporized. Hyperplasia of the gingiva, labial or lingual frena and epulis fissuratum were excised. The CO_2 laser was found to be effective in treating mucous retention cysts by marsupialization. Benign lesions, in the depth of the oral cavity (soft palate, oropharynx) were vaporized without general anesthesia. The hemostatic qualities of the CO_2 laser are effective in treating vascular lesions, such as hemangiomas or lymphangiomas. Examples of these conditions will be presented with demonstrative slides.

The TDCP - A Device to Measure Tightness of Dental Contact Point. **A.D. Vardimon, T. Brosh, M. Labeeb** (Section of Orthodontics, Goldschleger School of Dental Medicine, Tel Aviv University, Israel)

The Section of Orthodontics at Tel Aviv University has developed a novel device to quantitatively measure the tightness of adjacent teeth at contact point areas. Alterations in tightness vs looseness of teeth-contact points occur, for example, after orthodontic treatment, prosthetic rehabilitation, or periodontal diseases. These changes indicate an early signal of deleterious processes, such as relapse in orthodontic treatment results, breakdown in periodontal condition, or failure of the prosthetic implant. The unique characteristic of the TDCP device is its ability to assess any minute change in teeth tightness prior to clinical manifestation. The sequelae mentioned above have in comon a slow rate of progression. This feature calls for an accurate measuring system capable of detecting minute changes in teeth contact tightness over time. Using the TDCP device at any determined time interval will equip the dentist with a diagnostic tool which will provide an early alarm system so urgently needed in combating diverse dental diseases.

The TDCP device provides a simple, quick, yet accurate assessment to measure changes in tightness of teeth contact points. This technique has a wide range of application in diverse dental fields. For example, at the end of an orthodontic treatment, removable retentive appliances are placed in the mouth to maintain the accomplished result. The wearing time of the retentive appliances is successively reduced until a steady state of the oral tissues is achieved. However, the extent of this recovery process is individual and unknown. Thus, the orthodontist lacks a diagnostic tool to provide him with an alarm signal, *i.e.*, means to prevent relapse of the obtained result. A similar situation arises when a crown is installed over an intrabony metal implant. A tight contact point between a crown linked to the bony implant and an adjacent tooth can lead to collapse of the bony-bearing system.

The TDCP device is designed for dental application. Thus, its potential customers are dentists (general practitioners) who work in the fields of orthodontics, periodontics and oral rehabilitation (prosthodontics). However, the TDCP device can be sold over-the-counter so that the dental patient, instructed by his dentist, can take measurements at home and inform his dentist of a change in the TDCP between any certain teeth. This home care system is advantageous in light of the unpredicable and long-term mode of relapsed tooth movements.

In its current laboratory form, the TDCP device consists of a bow-jig which receives stainless steel metal strips of four different thicknesses (0.05 mm, 0.10 mm, 0.15mm, 0.20 mm). A sensor component (strain gauge) is linked to the base of the bow-jig. The sensor is able to detect any minute deflection of the bow-jig which occurs during insertion of the metal strip between the tight contact point of two adjacent teeth. The sensor response to the deflection is obtained by a strain indicator and the measured data recorded by a recorder. In its final commercial form, the TDCP device will be the size of an electric toothbrush.

Novel Sterilization and Infection Control Procedures. **R. Tuttnauer** (Tuttnauer Co. Ltd, Jerusalem)

Tuttnauer Co. Ltd is the world leading manufacturer of conventional table top autoclaves. The company is introducing the following new products: (a) a new prevacuum table top autoclave according to the new specifications of IEC; (b) a high speed autoclave with a complete 9 min cycle for sterilization of instruments and handpieces between patients; (c) Enviropak - a reuseable autoclavable sterilization pouch, that can be used up to 200 times without replacement; and (d) clean and simple - an ultrasonic/enzymatic solution dispensed in a unique tablet form which eliminates heavy handling, mixing and storage.

Properties of Nylon Sterilization Pouches in Table-Top Sterilization Processes. **M.M. Nir, G. Ramirez** (StePac L.A., Ltd., Tefen Industrial Park, Israel)

Nylon sterilization tubing and self-seal pouches were used to package simulated dental tools. The packages were then processed in various table-top sterilization processes. Sterility of the tools within the nylon products was achieved in dry heat and non-vacuum steam processes. Sterility was maintained when the packages were subjected to either ambient storage conditions or challenge conditions in which spore-inoculated powder was circulated around the packages.

Physical and structural properties of nylon sterilization wraps, both before and after steam and dry heat sterilization processing, were also studied and compared to those of paper/plastic sterilization pouches. Exposure to steam and dry heat leads to nominal changes in permeability and mechanical properties. Steam processed nylon products have reduced burst and seal strengths relative to presterilized products, while nylon products processed through one cycle of dry heat gave elevated seal and burst strengths. Mechanical tensile properties, and seal and impact strength of the nylon materials are clearly superior to those of the paper/plastic products. After repeated cycles of steam and dry heat exposure, the average burst strength of the nylon products dropped by about 50%; however, it is still on par or better than that of the paper/plastic products.

Treatment in the Oral Cavity Employing Flexible Waveguides. **A. Elboim, S. Calderon, I. Gannot, J. Dror, N. Croitoru** (Faculty of Engineering, Department of Electrical Engineering - Physical Electronics, Tel Aviv University; and Department of Oral and Maxillofacial Surgery, Beilinson Medical Center, Petah Tikva, Israel

The broad band transmission of laser wavelength by the flexible waveguides (plastic, silica) developed by us, enables either soft or hard tissue treatments, utilizing the advantages of the Er-YAG laser radiations for hard tissue and the CO_2 laser radiation for soft tissues. The performance of these waveguides is the best achieved for radiation transmission with wavelengths larger than 2.1 μm: transmission 90-95% per meter length, maximum coupled power 50 watts, minimum bending radius 5 cm. Due to the suitable performance of these waveguides for applications in dentistry, maxillofacial treatments and surgery were made. For example, combined use of CO_2 and Er-YAG lasers for implant site preparation and implant exposures, excisions of oral pathological conditions, surgical treatments of salivary gland diseases, mucosal diseases, physiological gingival pigmentations and preprosthetic surgical procedures on human patients. Follow-up of all cases showed complete healing without recurrence of the problems.